REMARKS

Entry of the above amendment and reconsideration of the above-referenced application in view of the above amendment, and of the following remarks, is respectfully requested.

Claims 1-12 are pending in this case. Claim 1 is amended herein.

The Examiner rejected claims 1-4, 6 and 8 under 35 U.S.C. 102(e) as being anticipated by Xi et al. (U.S. 7,026,238).

Applicant respectfully submits that claim 1 is unanticipated by Xi et al as there is no disclosure or suggestion in the reference of depositing a first barrier layer over inner sidewall and bottom surfaces of the via, etching selectively, in a PVD tool, the bottom surface of the via to substantially eliminate the barrier layer from the bottom surface; and then, depositing a second barrier layer over the inner surfaces of the via including the bottom surface of the via. Xi teaches depositing a first barrier and etching to remove the first barrier from the horizontal surfaces. Xi then teaches depositing a second barrier. Xi does not disclose or suggest etching the first barrier in a PVD tool as claimed. Accordingly, Applicant respectfully submits that claim 1 and the claims dependent thereon are unanticipated by Xi.

Applicant further notes that, in contrast to that asserted by the Examiner, the second barrier 220 is not show as deposited on the bottom of the via Fig. 5 of Xi. While the second barrier 220 is deposited on the horizontal surface 212 of the trench, it is not deposited on the bottom surface of the via, as required by the claim. The fact that second barrier 220 is not deposited on the bottom surface of the via is clearly discussed in the paragraph bridging columns 3 and 4 of Xi. Having the second barrier cover the bottom surface protects against copper diffusion through misalignment of the via to the underlying copper layer (see, paragraph [0040] and Fig. 2D of the instant specification). However, Applicant further notes that Xi discusses (at Col. 4 lines 7-9) that in another

embodiment the second barrier layer is deposited, at least partially at the bottom of the via.

Applicant further notes that Rozbicki teaches a simultaneous etch/deposition in a PVD chamber. This differs from the claimed invention in that claim 1 requires etching and after etching, depositing. Simultaneous etch/dep is not equivalent to etch followed by dep. Simultaneous etch/dep results in at least partial removal of the first barrier at the bottom of the via with no deposition of the second barrier across the bottom of the via as shown in Figure 3D. In contrast, the claimed etch followed by dep results in removal of the first barrier at the bottom of the via and deposition of the second barrier over the bottom of the via. Accordingly, Applicant respectfully submits that claim 1 and the claims dependent thereon are patentable.

The Examiner rejected claim 5 under 35 U.S.C.§ 103(a) as being unpatentable over Xi et al. (U.S. Patent 7,026,238) in view of Aoi (U.S. Patent 6,197,696).

Applicant respectfully submits that claim 5 is patentable over Xi in view of Aoi as there is no disclosure or suggestion in the references of depositing a first barrier layer, etching selectively the bottom surface of the via to substantially eliminate the barrier layer from the bottom surface, and depositing a second barrier layer, wherein the first barrier layer is a conformal barrier layer of plasma+silane treated CVD TiNSi. As noted by the Examiner, Xi fails to disclose or suggest the first barrier layer being a conformal barrier layer of plasma+silane treated CVD TiNSi. Aoi is applied to teach plasma + silane treatment. However, Aoi teaches a plasma CVD process with silane for forming thick insulating layers. Aoi does not disclose or suggestion plasma + silane treatment for a barrier layer, much less for TiNSi. There is no disclosure or suggestion in the references of the first barrier layer being a conformal barrier layer of plasma + silane treated CVD TiNSi.

There is no reason why one of ordinary skill in the art would have applied Aoi's plasma+silane method for forming an interlevel dielectric layer to the barrier layer of Xi. The Examiner argues that Aoi teaches plasma+silane for the purpose of providing an

organic/inorganic hybrid. While Aoi teaches an organic/inorganic interlevel dielectric layer, there is no reasoning provided as to why one of ordinary skill in the art would have desired this organic/inorganic property for a barrier layer. Aoi, itself, teaches forming a barrier layer and does not use the plasma+silane process in forming the barrier layer. At most, a combination of the references would suggest using Aoi's plasma+silane process to form the interlevel dielectric 204 of Xi, not barrier layer 220. There is no disclosure or suggestion in the references for applying Aoi's plasma+silane process to form TiNSi as required by the claim. Accordingly, Applicant respectfully submits that claim 5 is patentable over the references.

The Examiner rejected claim 7 under 35 U.S.C.§ 103(a) as being unpatentable over Xi et al. (U.S. Patent 7,026,238).

Applicant respectfully submits that claim 7 is patentable over Xi for the same reasons discussed above relative to claim 1 from which claim 7 depends.

The Examiner rejected claim 9-11 under 35 U.S.C.§ 103(a) as being unpatentable over Xi et al. (U.S. Patent 7,026,238) in view of Rozbicki et al. (U.S. Patent 6,607,977).

Applicant respectfully submits that claims 9-11 are patentable over Xi in view of Rozbicki as there is no disclosure or suggestion in the references of depositing a first barrier layer over inner sidewall and bottom surfaces of the via, etching selectively, in a PVD tool, the bottom surface of the via to substantially eliminate the barrier layer from the bottom surface; and then, depositing a second barrier layer over the inner surfaces of the via including the bottom surface of the via, as required by claim 1 from which these claims depend. Xi teaches depositing a first barrier and etching to remove the first barrier from the horizontal surfaces. Xi then teaches depositing a second barrier. Xi does not disclose or suggest etching the first barrier in a PVD tool as claimed. Rozbicki is applied by the Examiner to teach etching in a PVD chamber. Rozbicki teaches a simultaneous etch/deposition in a PVD chamber. This differs from the claimed invention in that claim 1 requires etching and after etching, depositing. Simultaneous etch/dep is

not equivalent to etch followed by dep. Simultaneous etch/dep results in at least partial removal of the first barrier at the bottom of the via with no deposition of the second barrier across the bottom of the via as shown in Figure 3D. In contrast, the claimed etch followed by dep results in removal of the first barrier at the bottom of the via and deposition of the second barrier over the bottom of the via. Accordingly, Applicant respectfully submits that claims 9-11 are patentable over Xi in view of Rozbicki

The Examiner rejected claim 12 under 35 U.S.C.§ 103(a) as being unpatentable over Xi et al. (U.S. Patent 7,026,238).

Applicant respectfully submits that claim 12 is patentable over Xi for the same reasons discussed above relative to claim 1 from which claim 12 depends.

In light of the above, Applicant respectfully requests withdrawal of the Examiner's rejections and allowance of claims 1-12. If the Examiner has any questions or other correspondence regarding this application, Applicant requests that the Examiner contact Applicant's attorney at the below listed telephone number and address.

Respectfully submitted,

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